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Robust Trapping, Removal and Super-Sensitive Characterization of Constituents and Trace Impurity in Sea Water Ⅱ

Masayuki Futamata

Saitama University

Summary

Purpose

It is crucially important to trap various metal ions such as Na^+, Mg^{2+}, K^+, and anions like Cl^-, Br^- and SO_4^{2-} from marine water to exploit marine water as natural resources and to remove pollutant materials for environmental protection. These metal ions and anions have been collected using ion-exchange resin and ICP-MS analysis. However, they in general need pre-treatment for water samples before the process. In addition, they do not provide detail information on chemical state of materials, for instance if Hg^{2+} ions detected are combined with organic molecules or not. We have investigated flocculation-surface enhanced Raman scattering (SERS), in which the surface state of metal nanoparticles (MNPs) are adjusted to form flocculates by diminished electrostatic repulsion of negatively charged MNPs, or by forming coordination bond via various organic molecules to utilized coupled surface plasmons between flocculated MNPs for highly-sensitive Raman spectroscopy. Here, we have investigated to establish the flocculation-SERS to apply to trap and analyze materials contained in marine water samples.

Summary

We have proved that Mg^{2+}, Ca^{2+} and SO_4^{2-} ions in addition to Na^+ and Cl^- ions are trapped and removed from marine waters with our flocculation-SERS method. Also we confirmed that other ions such as Li^+, Fe^{2+}, Cu^{2+} can be trapped by condensing natural water samples, for instance to 10 mM for monovalent ions and 0.1-0.3 mM for divalent ions. We also succeeded to elucidate solvated metal ions using flocculation-SERS. In addition, organic molecules like DNA, RNA bases were quantitatively trapped and detected by the same method we developed.

References

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